

## Section 820. TRAFFIC SIGNALS

**820.01 Description.** The Contractor shall furnish all materials and perform all work necessary to provide for the following as shown on the plans:

- A. Complete and operating traffic and pedestrian signals, span wires, strain poles, pedestals, illuminated case signs, traffic loops, and digital loop detectors/cabinets.
- B. The removal and either salvage or disposal of traffic and pedestrian signals, span wires, mounting assemblies, strain poles, pedestals, illuminated case signs, traffic loops, and digital loop detectors/cabinets.
- C. The relocation or reinstallation of existing traffic and pedestrian signals, mounting assemblies, strain poles, pedestals, illuminated case signs, and digital loop detectors/cabinets.

Unless otherwise specified, excavation, granular material, backfill, disposal of waste excavated material, together with (in kind) replacement of sod or seed, mulch, and fertilizer is also included and will not be paid for separately.

All traffic signals and flasher signals are abbreviated on the plans and in this specification as T.S. No. 1, T.S. No. 2, etc.

All left-turn, right-turn and straight-through green arrows are abbreviated on the plans and in this specification as L.T.G.A., R.T.G.A., and S.T.G.A., respectively.

Case signs are abbreviated on the plans and in this specification as C.S.

**820.02 Materials.** Materials shall meet the following requirements.

Span Wire . . . . .	921
Vehicular Traffic Signals and Mounting Assemblies . . . . .	921
Pedestrian Signal (Incandescent Type) . . . . .	921
Traffic Signal Strain Pole . . . . .	921
Traffic Signal Pedestal . . . . .	921
Illuminated Case Signs . . . . .	921
Traffic Loop . . . . .	918, 921
Digital Loop Detector/Cabinet . . . . .	921

Certain components of vehicular traffic signals and mounting assemblies detailed on the plans and not specified in section 918.04 shall be subject to the approval of the Engineer.

### 820.03 Construction.

- A. **Span Wire.** The Contractor shall install span wire and guys and all required fittings according to the plans or as directed by the Engineer.
- B. **Vehicular Traffic Signals, Pedestrian Signal (Incandescent Type) and Mounting Assemblies.**

Signals and mounting assemblies shall be removed, installed or relocated as shown on the plans. Existing traffic signal (T.S.) equipment shall not be removed unless approved by the Engineer. Removal of signals shall be done in stages or when adequate alternate signals, as determined by the Engineer, are installed.

T.S. heads shall be wired with color coded wire according to the owner's specifications and as shown on the plans.

T.S. heads shall be assembled with fittings wired as called for.

Any required installation of new T.S. cable to the existing T.S. heads due to the relocation or removal/installation of the T.S. controller and cabinet is included in the payment item for the controller and will not be paid for separately.

The suspension T.S. shall be hung in a vertical plane, the heads properly faced, and all lock nuts securely tightened and the tops of the traffic signals shall be sealed with a construction grade silicone sealant.

At locations where T.S. span adjustment by the local utility company is required to maintain the proper T.S. mounting height, it shall be the Contractor's responsibility to coordinate this work with the local utility company and give them a minimum of 48 hours notice before this work is to be performed. The necessary labor involved by the Contractor in this T.S. span adjustment shall be included in the payment item for the installation of traffic signals and will not be paid for separately.

For bracket arm signals, a hole shall be drilled in each standard, as indicated at each location, to pass the bracket arm cable entrance inlet. Where specified, two holes shall be drilled in the standard so that signal cable may be looped in the lower bracket and out the upper bracket to the signal. The bracket arm signals shall be installed in a vertical position on their respective standards, properly faced, and the lock nuts securely tightened.

Traffic signal fittings (screws, bolts, pinnacles, etc.) shall be greased with a non-oxide type grease.

Preforms shall be used on guy wires.

Wire connections shall be made with approved nylon insulated solderless connectors and taped with at least two layers of friction tape, half-lapped.

Overhead line construction shall conform to the National Safety Code, National Electric Code and the Michigan Public Service Commission. Construction shall be equal to and, in most cases, similar to existing construction.

Signal lamps shall meet ITE standards and shall have brass bases.

Equipment and materials to be removed and not specified for storage for MDOT will become the property of the Contractor and disposed of away from the site.

T.S. heads and bracket arms shall be field painted according to MDOT Specifications.

Wiring shall be according to the Owner's Traffic and Safety Division's method. Timing and offset of the signals shall be as specified and put into operation by the Owner's Traffic and Safety Division.

Cables are to be installed on poles or in ducts, where indicated on the plans. The cable arrangement shall be as shown on the plans.

Signal cables shall be installed in one length without joints from the controller to each signal, except as indicated otherwise on the plans. Care must be exercised so that the cable is not damaged or kinked when being pulled through the ducts. Cables shall be

trained near the top of the wall or manhole or handholes, and bends in the cable shall not damage the cables.

Cables are to be bundled together under 1½ inch wide lead straps and shall be secured to the wall of the manhole and handhole with galvanized A. & J. anchors, or approved equal. A maximum spacing of 2 feet shall be maintained between supports.

The sheath of the traffic signal cables shall be brought into the signal traffic heads and shall extend for a minimum of one inch into the controller cabinet. All traffic signal cables shall be securely strapped inside the controller cabinet. Each traffic signal cable shall be tagged and stamped according to MDOT practice.

Present traffic signal service shall be maintained with a minimum of interruption during the relocation of traffic signal equipment. The Contractor shall notify MDOT, 48 hours in advance of relocation of controllers or otherwise shutdowns of traffic signals so that adequate police protection can be provided at the intersection. Refer to maintaining traffic requirements for more information.

Pedestrian signal units include housing, visors, optical units, mounting brackets, lamps and wiring.

The Contractor shall notify MDOT Traffic and Safety Division and the appropriate local utility when a traffic signal load is added to or removed from service.

#### **C. Traffic Signal Strain Pole and Traffic Signal Pedestal.**

1. Traffic signal pedestal equipment shall be as shown on the plans and suitable for mounting traffic and pedestrian signals.
2. Strain poles shall be anchor base type steel pole, including anchor bolts and associated hardware, as shown on the plans, to support span wire and bracket arm mounted traffic signals.

The pole shall be oriented on the foundation so that the handhole is located on the side of the shaft perpendicular to the span direction or as directed by the Engineer.

The pole shall be grounded as shown on the plans.

Poles shall be raked so that the upper third of the shaft is in a true vertical position when loaded.

The pole shall be installed so that the foundation and anchor bolts are perpendicular to the span direction or as directed by the Engineer.

Foundations shall be properly protected and guarded to prevent injury to persons until the standards are installed. The lower portion of the foundation shall be placed without forms unless the soil is subject to cave-in and the use of forms is authorized by the Engineer. Forms shall be used to shape the upper part of the foundation. Top surface of the foundation shall be horizontal and at the elevation shown on the plans or established by the Engineer.

Unless directed by the Engineer, no foundation shall be placed until the curb is in place.

Concrete shall fill the entire hole excavated for the foundation. Forms shall not be used except to form the foundation top, without prior approval of the Engineer.

No construction rubble, broken sidewalk or other foreign material will be permitted in place of concrete. Cracked or otherwise defective foundations will not be accepted.

Ground rods and ground wires shall be installed. The ground wire shall be connected to the ground rod with a copper clad steel solderless type clamp. The connection must be electrically solid and mechanically secure.

Foundations which require backfill shall have the backfill placed in layers not more than 12 inches in depth and compacted to not less than 95 percent of its maximum unit weight. The backfill shall be placed according to section 206.

Non-hazardous contaminated material from drilled shafts shall be disposed of at a Type II landfill according to environmental regulations and the contract documents.

Unless directed by the Engineer, standards shall not be installed on foundations until the concrete has been cured for a minimum of 7 days.

- D. **Illuminated Case Signs.** Internally illuminated case signs shall be wired with color coded wire according to the owner's specifications and as shown on the plans.

Case signs shall be assembled with fittings wired.

Wire connections shall be made with approved solderless connectors and taped with at least two layers of friction tape, half-lapped.

All equipment and materials to be removed and not specified for MDOT storage will become the property of the Contractor and disposed of away from the site.

- E. **Electrical Wire and Cable.** This work consists of furnishing, installing, and removing traffic signal wires and cable in accordance with section 819.
- F. **Conduit.** This work consists of furnishing, installing, relocating, and removing direct buried and encased conduit and all associated fittings in accordance with section 819.
- G. **Wood Pole.** This work is shall be in accordance with section 819.
- H. **Traffic Loop.** Each slot in the pavement shall be cut in accordance with the applicable portions of subsection 603.03 and as shown on the plans.

The slots which are to be wired shall be blown clean and dry to be free of dirt, dust, and other material such as oil, grease, etc. That could affect bonding of the sealant prior to wire laying.

The wire shall be laid in the slot in a manner to minimize sharpness of the necessary bends. The wires shall lie loose in the slot.

Loops shall be centered in all traffic lanes unless designated otherwise on the plans or by the Engineer. The loop shall not enclose any joints, cracks, or ferrous material such as manholes, handholes, and other castings.

All wire used in the loop and its lead-in shall be installed in a manner to be free from kinks, abrasions, or punctures of the installation. Tools employed in laying the loop wire must be chosen with particular care to meet this requirement. Use of screwdrivers and similar sharp instruments is prohibited.

Each loop with dimensions up to 10 by 10 feet (40 lineal feet) shall contain three turns of wire. Larger sized loops shall contain two turns of wire. All loop lead-ins shall be tightly twisted with a minimum of two turns per foot and in such a manner as to prevent mechanical movement between the individual wires.

All loop lead-ins shall be brought into a handhole at the time the loop is placed in the pavement and shall, in any event, be protected against any physical damage. The ends shall be taped to prevent water from entering the wire.

The loop wires should be placed at least ½ inch below the surface of the slots cut in the pavement, and the slots shall be filled with sealant. If necessary, to keep ½ inch of sealant over the top wire, small soft restraints may be used to hold the wires in position, but must be completely covered by the sealant. The sealant should not project above the road surface, and, before setting, any surplus sealant shall be struck off level with the surface without the use of solvents. The sealed area may be opened to traffic as soon as the sealant has set hard as determined by the Engineer.

Placement of the sealant material shall be consistent with the manufacturer's instructions. All persons handling this material shall be made aware of the manufacturer's recommended application specification and procedures.

No solvents, thinners, or other solids shall be mixed with this sealant for encapsulation.

Approval of the Engineer shall be obtained for any change in loop locations to avoid cracks or other undesirable feature of a site.

The Engineer may change loop locations prior to sawing.

The application temperature range shall be between 40 and 100 ° F or as directed by the Engineer. No detector loop shall be installed unless the roadway surface temperature is 40 ° F or above for a minimum of 12 hours after sealant application.

The resistance to ground of the loop and its lead-in shall be a minimum of 1.0 meg ohm under any weather or moisture condition. In the absence of circuit grounds, a temporary ground may be provided by a driven ground rod.

Each loop shall be tested for continuity at the handhole. This resistance shall not exceed 1.5 ohms.

- I. **Digital Loop Detector/Cabinet.** A digital single channel loop detector, and cabinet when required, shall be installed as shown on the plans.
- J. **Site Restoration and Waste Disposal.** As directed by the Engineer and in accordance with section 204.

#### 820.04 Measurement and Payment.

Contract Item (Pay Item)	Pay Unit
TS, __ Way __ Mtd .....	Each
TS, __ Way __ Mtd, Salv .....	Each
TS, __ Way __ Mtd, __ .....	Each
TS, __ Way __ Mtd, __ , Salv .....	Each
TS, 4th Level __ .....	Each
TS, 4th Level __ , Salv .....	Each
Louver .....	Each

TS, __ Mtd, Rem	Each
TS, Pedestrian, __ Way __ Mtd	Each
TS, Pedestrian, __ Way __ Mtd, Salv	Each
TS, Pedestrian, __ Mtd, Rem	Each
TS Lens, Pedestrian, Sym	Each
Pushbutton	Each
Pushbutton and Sign	Each
Pushbutton, Rem	Each
Strain Pole, Steel, Anchor Base, __ foot	Each
Strain Pole, Steel, Anchor Base, __ foot, Salv	Each
Steel Pole, Rem	Each
Strain Pole, Steel, Anchor Fdn	Each
Strain Pole Fdn, Cased	Feet
Strain Pole Fdn, Uncased	Feet
Fdn, Rem	Each
Pedestal, Fdn	Each
Pedestal, Alum	Each
Pedestal, Alum, Salv	Each
Pedestal, Rem	Each
Case Sign, __ Way, __ inch by __ inch	Each
Case Sign, __ Way, __ inch by __ inch, Salv	Each
Case Sign, Disappearing Legend, __ inch by __ inch	Each
Case Sign, Disappearing Legend, __ inch by __ inch, Salv	Each
Case Sign Panel	Each
Case Sign, Rem	Each
Keep Rt Sign, Rem	Each
Case Sign Panel, Rem	Each
Service Disconnect	Each
Safety Switch	Each
Span Wire	Each
Span Wire, Rem	Each
Anchor Guy	Each
Strut Guy	Each
Traf Loop	Each
Traf Loop, __	Each
Digital Loop Detector, __	Each
Digital Loop Detector, and Cabinet, __	Each
Riser	Each

The items listed include all costs associated with completing the work as described. Unless otherwise specified, excavation, granular material, backfill, disposal of waste excavated material, together with (in kind) replacement of sod or seed, mulch, and fertilizer is also included and will not be paid for separately.

#### A. Traffic Signals (TS).

1. Traffic Signals includes traffic signal head (salvaged, when appropriate), any pipe extensions needed to maintain 17feet of underclearance, lamps, fittings, wiring, line hardware, grounding, cable to controller, and other material required to complete the

work. Payment includes installing the number of louvers required for a signal face. **Louvers** will be paid for separately.

2. **TS, Rem** includes the removal of traffic signals and associated hardware. Removal of cable and wire from controller to signals and between signals and storage or disposal of materials is also included.
3. **TS, Pedestrian** includes pedestrian traffic signal heads (salvaged, when appropriate), bracket arms, risers, cable to controller, wiring, grounding, lamps, fittings, and other material required to complete the work.
4. **Pedestrian TS Lens, Sym** includes removing the old lens and furnishing and installing the new lenses (two per signal) and other material required to complete the work.
5. **Pushbutton** includes a pushbutton, sign (when appropriate), cable to controller, wiring, grounding, brackets, risers, fittings, conduit, and other material required to complete the work.
6. **Pushbutton, Rem** includes the removal of the pushbutton, sign, supports, fittings, wiring, line hardware, ground rod(s), conduit risers, cable and other material required to complete the work. Storage or disposal of materials is also included.

#### B. **Strain Poles.**

1. **Strain Pole, Steel, Anchor Base** includes installing the steel standard (salvaged, when appropriate) on the foundation and properly raking the standard.
2. **Strain Pole, Steel, Anchor Fdn** includes constructing the foundation and installing conduit bend(s), grounding and grounding rod(s), and utilization of forms as directed by the Engineer for foundation excavation, if required.
3. **Strain Pole Fdns, Cased and Uncased**, shall be measured vertically from the bottom of the shaft to the top of the shaft. The work shall include installing conduit bend(s), grounding and grounding rod(s), utilization of steel casing for foundation excavation, if required.
4. **Fdn, Rem** includes the removal of the foundation and backfilling the hole with granular material.

#### C. **Pedestals.**

1. **Pedestal, Alum** includes installing pedestal (salvaged, when appropriate), fittings, ground rod(s), ground wire and other material required to complete the work.
2. **Pedestal, Fdn** includes excavating and constructing a new concrete foundation and installing grounding and ground rod(s) and other material required to complete the work.
3. **Pedestal, Rem** includes the removal of pedestal and associated hardware.

#### D. **Case Signs.**

1. **Case Signs** of the size and number of faces shown includes installing the internally illuminated case sign (salvaged, when appropriate), lamps, fittings, wiring, line hardware, grounding, cable to controller and other material required to complete the work.

2. **Case Sign Panel** of the size and with the legend as shown includes installing the case sign panel and necessary hardware required to complete the work.
  3. **Case Sign, Rem** includes the removal of the illuminated sign, and associated hardware. Removal of cable and wire from controller or service tap to illuminated sign and storage or disposal of materials is also included in the item.
  4. **Case Sign Panel, Rem** includes the removal of the case sign panel and all associated hardware. Onsite material storage or disposal of materials is included in the item.
- E. **Safety Switch or Serv Disconnect** includes installing the disconnect (or safety switch), fuse(s), ground rod(s), ground wire, service cable, PVC schedule 80 or galvanized rigid metal pipe risers, concrete encased conduit bend(s), or any other material required by the local utility company and the National Electric Code to complete the work.
- F. **Span Wire.**
1. **Span Wire** includes installing the new span wire, insulators, guys, anchors, associated hardware, grounding and other material required to complete the work.  
  
Any span wire which is not called for to be changed out in the contract or by the utility company, but is requested by the Contractor, will be considered as being changed to facilitate ease of construction by the Contractor and must be arranged and paid for by the Contractor.
  2. **Span Wire, Rem** includes the removal of the span wire and associated hardware and disposal from the site.
- G. **Anchor Guy** and/or **Strut Guy** of the size shown on the plans, will be measured as a unit and includes installing the guy wire, anchor rod, anchor, (strut when appropriate) and all hardware necessary to complete the work.
- H. **Traf Loop** and **Traf Loop**, \_\_ are measured as units. The unit shall be as indicated on the plans. The unit includes the loop installation at the intersection. This work includes sawing the slots in the pavement, making the expansion joints, installing all wires in the saw slots, placing caulking in all ends of conduit, sealant and the shielded cable within conduit from its connection to the loop wire in the handhole to the traffic signal controller or digital loop detector cabinet and the connection within the cabinet to the loop detector.
- I. **Digital Loop Detector** and **Digital Loop Detector**, \_\_ are measured as units. The unit shall be as indicated on the plans. This work includes installing in the existing cabinet, a digital loop detector (salvaged when appropriate), cable to loop terminal in handhole, grounding, conduit, fittings and other material required to complete the work.
- J. **Digital Loop Detector and Cabinet** and **Digital Loop Detector and Cabinet**, \_\_ are measured as units. The unit shall be as indicated on the plans. This work includes installing a digital loop detector, cabinet (salvaged when appropriate), 4 inch by 6 inch treated wood post if necessary, mounting hardware, cable to loop terminal in handhole, grounding, conduit, fittings and other material required to complete the work.
- K. **Riser** of the type specified on the plans will be measured as a unit. This work includes installing the PVC schedule 80 or galvanized rigid metal pipe riser, necessary weather head and all associated hardware to complete the work. Wire arrangement on all poles is included in the item and will not be paid for separately.